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compressor [7] from going into this catastrophic surge [8] condition. So it is always on.

[9] It's ready and waiting, and it [10] continues to operate, generating these signals [11] while this — as this system continues, because [12] both of these have to be in parallel. Otherwise [13] you don't know where you are. So nothing gets [14] shut down, nothing gets locked out. Everything [15] continues to operate.

[16] We just adjust values in order to [17] respond to the special characteristics of your [18] compressor curve, of Sundstrand's — not even the [19] compressor curve, the way Sundstrand has chosen to [20] measure its compressor flow, which is another [21] issue entirely.

[22] **Q:** So when the system is in high flow, the [23] proportional and integral control signals are [24] present, they're just not used?

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[1] **A:** They are — well, "used" is an odd word. [2] They are there and "use" means, as far from my [3] standpoint as an operator, I'm looking at the [4] surge control system for what it's intended [5] purpose is, which is the surge control system does [6] not live for the purpose of keeping the surge [7] control system alive. It has a purpose.

[8] Its purpose is to protect the [9] compressor. And it continues to protect the [10] compressor by maintaining continuous operation as [11] the high and low flow continues to maintain [12] continuous operation to insure that it's always [13] ready and prepared to monitor the position of the [14] bleed control valve.

[15] So under no circumstances I allow [16] the compressor to go into surge.

[17] **Q:** Could you highlight the bottom line?

[18] **A:** This is, excuse me, you've shown 12C, I [19] believe, figure 12C.

[20] **Q:** Exactly.

[21] **A:** Yeah. This is 12C. Is this portion here [22] on PTX 953? That's the same thing, right?

[23] **Q:** No, Mr. Muller, that's not 12C, I don't [24] believe.

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[1] **A:** This is 12C.

[2] **Q:** This tells you what is inside this box is [3] shown by 12C.

[4] **A:** I'm saying —

[5] **THE COURT:** Let Mr. Herrington pose [6] the questions to you.

[7] **THE WITNESS:** I'm sorry.

[8] **BY MR. HERRINGTON:**

[9] **Q:** If you could pull out that, please.

[10] **THE COURT:** Do you want him to [11] resume his seat, counsel?

[12] **MR. HERRINGTON:** Sure.

[13] **MR. PUTNAM:** I think the witness [14] has that document in front of him.

[15] **BY MR. HERRINGTON:**

[16] **Q:** Mr. Muller, this, I believe, illustrates [17] what happens as a result of switching the system [18] between high flow and low flow?

[19] **A:** Is that a question?

[20] **Q:** If you could look at figure 12C at the [21] bottom. Do you see BCVCTL coming in from the [22] left?

[23] **A:** Yes, I do.

[24] **Q:** That's the control signal by generating a

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[1] desired value of DELPQP to the actual value?

[2] **A:** Yes, that value of BCVCTL is the value [3] I've been pointing to on the chart.

[4] **Q:** The guide vane position plays no role in [5] that process?

[6] **A:** The guide vane position in that specific [7] one we use temperature, yes.

[8] **Q:** BCVCTL is calculated based on the other [9] figure we looked at and it comes along and bleed [10] select decides whether it will be used or not [11] used; correct?

[12] **A:** No, what it does, what it does is it [13] actually — it's always using it, when you say [14] it's not being used, what it's doing is that at [15] that point, that point where you have BCVCTL [16] (0/one), that is the output of the other, of the [17] other figure that I've shown where there it then [18] goes and where it says, do you see where — right [19] now the position it's in right now is basically [20] associated with low flow.

[21] And that is the BCVCTL signal is [22] coming out and it is continuing on through because [23] you have these two contacts that are being made [24] and the bleed control valve moderates to avoid

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[1] surge.

[2] And then as a result of the IGV [3] position, the IGV position then determines that [4] we're in high flow. This is the area right here [5] where that little horizontal thing that's [6] connecting that comes off BLD SCL and then goes up [7] a vertical line. That little what looks like a [8] cap up on top, it now moves up, kind of pivots and [9] it pivots from the right hand and pivots at 45 [10] degrees and makes contact with the upper portion, [11] which is connected to KSRGMX. And KSRGMX is the [12] maximum signal which I've been referring to which [13] opens the bleed control valve to allow all the [14] flow to go to the aircraft.

[15] **Q:** And KSRGMX is proportional and integral [16] control signal?

[17] **A:** That is a signal, a fixed signal which [18] then goes out. What is occurring is just that [19] signal coming in by going to the KSRGMX and [20] providing a fixed signal.

[21] **Q:** Not a proportional integral control [22] signal?

[23] **A:** As a fixed signal, yes, that's right.

[24] **Q:** So the affect of switching from zero to

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[1] one determines whether the proportional and [2] integral control signal is used. And whether a [3] nonproportional and integral control signal is [4] used to control the bleed valve?

[5] **A:** Yes. It's used to the extent that — [6] let's remember that the proportional and integral [7] control signal continues to be used and consistent [8] with what's said in the patents.

[9] It adjusts that signal by going to a [10] fixed signal only during that special portion of [11] high flow operation.

[12] But meanwhile, meanwhile during this [13] entire time, those proportional and integral [14] control signals continue to be generated and are [15] continuously available.

[16] **Q:** They continue to be generated then?

[17] **A:** And are available for use by the surge [18] control system at all times.

[19] **Q:** And their magnitude is the same in high [20] flow as it would be in low flow?

[21] **A:** No, the BCVCTL control valve varies. If [22] it were the same as the KSRGMX value, then why [23] would you need a separate value?

[24] **Q:** Are you aware of the double solution

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[1] behavior of DELPQP?

[2] **A:** Yes, I'm aware of it, but what you said [3] is not in relationship to that. What you said —

[4] **Q:** Mr. Muller, the manner in which the [5] proportional and integral control signal is [6] calculated does not change according to whether [7] the system is in high flow or low flow?

[8] **A:** As I said, or as I've shown in figure [9] 12a, 12a doesn't know anything about this. 12a [10] continues to make those measured values. It [11] continues to look at Delta P over P, look at [12] temperature, look at pressure, continues to [13] oper-

ate, it's ignorant of all this stuff.

[14] Along the way, along the way those [15] values get adjusted because of the compressor [16] curve, which I'm referring to, which as you just [17] referred to as a double solution curve which is [18] really this peaky curve which is generated with [19] APS 3200 only because it measures — it measures [20] flow in a special way which is special to the [21] 3200, not the only way. It's just the way that's [22] done there generating this funny looking curve.

[23] And so what you have here is that [24] because of this odd curve which you have, the NPNI

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[1] controller continues to operate, but since you [2] have this odd control with odd response you adjust [3] that value to accommodate for the way you have [4] generated this curve in order to give a constant [5] value to open up at high flow, to open up at bleed [6] control value so all the flow goes to the [7] aircraft.

[8] No matter how we look at it and how [9] we play back and what context, that idea never [10] changes.

[11] **Q:** And the signal that is provided to the [12] control valve in high flow is a different signal [13] from BCVCTL?

[14] **A:** It may be.

[15] **Q:** There are times when it is not?

[16] **A:** I'm not sure. But one thing I am sure of [17] is that when it does go to high flow, it gets a [18] fixed signal.

[19] **Q:** And that's not a proportional and [20] integral control signal?

[21] **A:** That is a fixed signal. That's right.

[22] **Q:** And it's not BCVCTL?

[23] **A:** That's right, it's not BCVCTL.

[24] **Q:** Now, the relationship between the

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[1] variations in DELPQP and the proportional and [2] integral control signals, that's reflected in [3] BCVCTL; correct?

[4] **A:** I think so. I'm sorry, I'm trying to [5] remember the exact way you asked the question. [6] Could you repeat that again, please?

[7] **Q:** Sure. The relationship between the [8] variations the DELPQP and the magnitude of the [9] proportional integral control signals is contained [10] in BCVCTL?

[11] **A:** DELPQP feeds in the proportional and [12] integral controller which generates a signal which [13] is used by the bleed control valve. Is that [14] consistent with what I just said with what you [15] were asking?

[16] **Q:** Right.

[17] **A:** Than the answer to that is yes.

[18] **Q:** If you could please look at Claim 4, [19] element C.

[20] Mr. Muller, if you have a copy of [21] the '194 patent, I believe that's de*p1565Xf ndants [22] exhibit —

[23] **A:** Give me a moment to find it in this stack [24] here.

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[1] **Q:** Okay.

[2] **A:** Yes. Sorry. You seem to have given me [3] two copies of '893 — I'm sorry, no. It's my [4] mistake. I do have a copy of '194.

[5] **Q:** Thank you.

[6] If you could look at the last page, [7] and that's Claim 4, and I would like to ask you [8] about element C, and in particular the last line [9] of element C, the last three lines.

[10] Element C refers to generating [11] proportional and integral control signals in [12] response to variations in —

[13] **A:** I'm sorry, could you say exactly what [14] portion you're starting at? I'm trying to follow [15] you.

[16] **Q:** Let me ask you generally about element [17] C. That relates to generating proportional and [18] integral control signals in response to variations [19] in the values of the flow-related parameter; is [20] that fair?

[21] **A:** Allow me to read it again just to make [22] sure. Yes.

[23] **Q:** So the proportional and integral control [24] signals are generated in response to the

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[1] variations in the flow-related parameter?

[2] **A:** Yes.

[3] **Q:** And then the last three lines of element [4] C require simultaneously utilizing said integral [5] and proportional control signals to operate said [6] surge bleed valve, is that fair?

[7] **A:** That's the correct reading, yes.

[8] **Q:** Now, in your opinion, is that requirement [9] that to utilize the integral and proportional [10] control signals to operate the surge bleed valve [11] require that the system actually utilizes the [12] proportional and integral signals to operate the [13] bleed valve?

[14] **A:** What it says, what it says is that this [15] is a provision which basically states that the [16] integral and proportional control signals [17] simultaneously generated, control to operate — [18] let me just — it's the way the wording is phrased [19] here.

[20] Yes, what it refers to, it basically [21] just refers to the generation of these signals. [22] And then it says, and basically it says these [23] signals are generated to operate the valve. And [24] in fact that's what occurs.

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[1] **Q:** My question is, where it says utilizing [2] said integral and proportional control signals to [3] operate said surge bleed valve, does that [4] necessarily require that the integral and [5] proportional control signals are used to operate [6] the said surge bleed valve?

[7] **A:** What it says is that these valves are [8] generated to operate the valve. It does not say [9] to what extent they're operated, over what range. [10] It just simply states that the flow parameter is [11] used, fed through a proportional and integral [12] controller to generate a signal that is available [13] to the bleed control valve, or to a surge control [14] valve, or in the case to a surge bleed valve, as [15] the wording in the patent.

[16] **Q:** Just to be clear, it states utilizing [17] said integral and proportional control signals to [18] operate said surge bleed valves?

[19] **A:** Yes, which is exactly what it does.

[20] **Q:** Does it require that they be utilized to [21] operate the said bleed valve?

[22] **A:** It says nothing here about whe it's used [23] and to what extent it's use It basically says [24] that it's available to be used to operate these,

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[1] the surge bleed valves.

[2] **Q:** So a system in your — could, in your [3] view, satisfy about this language but not [4] utilizing said integral and proportional control [5] signals to operate said surge bleed valve?

[6] **A:** This language does not put constraint to [7] the utilization of the signals widely proportional [8] and integral controllers to operate the said bleed [9] control valve. It actually states that they be [10] available to be used to operate the surge bleed [11] valve, that's the extent of what the statement [12] says, in my reading.

[13] I mean, I can see where there could [14] be disagreement on that, but that's the way I read [15] that.

[16] **Q:** Now, you are aware that in the APS 3200 [17] in high flow, the surge control system does not [18] utilize said proportional and integral control [19] signals to operate the bleed valve?

[20] **A:** Well, as I've said several times, [21] utilizes them to the extent that continues to [22] generate them. And it generates them to make them [23] available to operate the bleed control valve.

[24] **Q:** But they're not operating the

bleed valve

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igh flow?

[2] A: When they are in high flow a fixed value [3] is sent out to fix the bleed control, the bleed [4] valve open, but the proportional and integral [5] signals still generate a control voltage available [6] to the APS 3200 bleed control valve.

[7] Q: Mr. Muller, I just want to ask you about [8] your range of expertise, and in particular [9] expertise as an expert witness.

[10] Now, as part of your report in this [11] case you were required to disclose other cases in [12] which you've testified as an expert witness?

[13] A: That's correct.

[14] Q: And in the Pitney Bowes versus Baker [15] Industries, you were an expert with respect to the [16] corrosion of a fuel tank; is that fair?

[17] A: That's correct, yes.

[18] Q: What did that case involve?

[19] A: Well, that case involved — this was a [20] site in Morris County, New Jersey. And what had [21] happened is on the Pitney Bowes campus, corporate [22] campus — Pitney Bowes is the people t[h] ou know [23] with the mail stamp- ings and they had rather [24] e sive facilities. And they had these

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[1] underground fuel tanks.

[2] And what had happened was they had [3] found that the fuel tanks had begun to leak. And [4] the water table in that area is fairly high, so as [5] you're I'm sure familiar with the fuel oil that [6] was leaking from the tank began to be detected in [7] wells that they locate around fuel tanks and they [8] began to find that there was fuel oil in the [9] water.

[10] Naturally, this is a very serious [11] environmental matter and there are laws dictating [12] as to the extent of cor- rection that has to be [13] done.

[14] And so there was a rather [15] sig- nificant lawsuit involving a wide range of [16] companies and many, many lawyers. And I was — [17] and the claim was made that the reason — that the [18] reason the fuel tank — the reason the fuel tank [19] was leaking was because it was due to the [20] installation of the fuel tank itself. And that [21] there would have been errors made in it and it was [22] the kind of h[a] ou would expect.

[2] [C]one said the fuel tank was [24] improperly installed. It was damaged in he

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[1] process. It was improperly made in the first [2] place.

[3] So what I did, what the expertise [4] that I brought was as a mechanical engineer. Part [5] of your training as a mechanical engineer is to be [6] involved in the knowledge of stress analysis, that [7] is when things are under stress, if you put a load [8] on something, what is the effect.

[9] And also corrosion, because [10] corrosion has an effect on stress, that is if [11] things corroded, the effect of stress can have [12] greater or less effect.

[13] And what I did is I made an analysis [14] to find out what actually was the likely causes of [15] the failure of the tank that resulted in the [16] leakage.

[17] And from my analysis, I determined [18] that it was not an installation problem, that in [19] fact it was a corrosion problem. And the [20] corrosion problem which by the way is a common [21] problem to everyone's fuel tank, that is if you [22] have — if you get water in your tank and the oil [23] goes on top, the interface where the oil and water [24] meet in your oil tank is just the area where you

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[1] have just at where the oil level and the water is, [2] that's just the area where you begin to get an [3] awful lot of corrosion.

[4] And that corrosion, even though the [5] rest of the tank confined, that corrosion can work [6] its way through unbeknownst to you because it's at [7] the bottom of the tank so you end up losing oil [8] going through it.

[9] I was able to demonstrate that in [10] fact that was the condition in that fuel tank and [11] as a result all the plaintiffs quickly came to a [12] settlement to my client's satisfaction.

[13] Q: Thank you, Mr. Muller.

[14] That case in which you served as an [15] expert witness, you were not an expert with [16] respect to surge control of a compressor?

[17] A: When I did that case, I was also an [18] expert in surge control systems.

[19] Q: What I meant is you served as an expert, [20] but on a different subject?

[21] A: Yes, that's right.

[22] Q: And you also were an expert witness in [23] Hartford Steam Boiler versus Cummings Power case?

[24] A: That's correct, yes.

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[1] Q: I don't mean to cut you off, but I want [2] to get in a sentence or two. The subject of your [3] expertise as a witness in that case. You were an [4] expert witness on the question of diesel engines [5] and maintenance work on diesel engines?

[6] A: Yes. That drew on the experience I had [7] over many years as part of plant operations where [8] I was involved as part of my — as part of my [9] overall responsibility I was responsible for, in [10] some cases, purchasing and maintaining and testing [11] the diesel powered emergency pumps that they have [12] in refineries and chemical plants.

[13] And what those are, are in refining [14] of chemical plants, if you have a fire, and [15] particularly as a result of a storm, and you lose [16] power coming into the plant, you may not have [17] power available to put a fire out because all of [18] your pumps have suddenly been shut down.

[19] And so what you need in your fire [20] hydrants, you need a secondary source of pumps to [21] generate water pressure, and in order to be able [22] to put out a fire, if you should be part of a [23] major power failure. The way that could be [24] accomplished in most plants is the use of a large

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[1] diesel engine, and that diesel engine is connected [2] to a pump and that draws water from the usual [3] sources of water and pressurizes the fire water [4] system.

[5] And that use of diesels is a very [6] important one. And over the years in my [7] responsibility for plant, for plant projects, when [8] I was a — when I was a supervisor and section [9] head of a technology group at the refinery, as [10] part of start-up responsibilities, and also in the [11] evaluations of the purchasing of diesel engines, [12] and occasionally where diesel engines were used [13] and where they failed as part of a troubleshooting [14] group, I became — I developed an expertise in [15] their operation and I was able to use it in this [16] particular instance here in Hartford.

[17] That was a case where it was the [18] Connecticut General Insurance Company —

[19] MR. HERRINGTON: Your Honor, do I [20] have the opportunity to —

[21] THE COURT: Yes, you may interrupt.

[22] MR. HERRINGTON: I believe a lot of [23] this is nonresponsive to what I've asked for and [24] it's using up my time on the clock.

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[1] THE COURT: If you would put the [2] question in a more focused fashion, [3] Mr. Herrington, it will be a more focused answer.

[4] BY MR. HERRINGTON:

[5] Q: Let me ask you about an another case [6] where you testified as expert witness in the last [7] four years?

[8] **A:** Thoroughly I testified in that Cummings [9] case, also.

[10] **Q:** In a case called Teresa Sorentino versus [11] Amaco Oil, isn't it true that you testified as an [12] expert witness on whether a fueling terminal [13] caused the death of a truck driver?

[14] **A:** That's correct.

[15] **Q:** And that involved the safety aspects of [16] the fuel terminal, correct?

[17] **A:** That drew on the plant safety expertise [18] that I had gained in plants over the years, yes.

[19] **Q:** Now, you actually list yourself as [20] available as an expert witness with an agency [21] called TASA?

[22] **A:** I use a firm called Technical Advisory [23] Service for Attorneys.

[24] **Q:** And that's an agency where people who

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[1] want to be expert witnesses will list themselves [2] so that lawyers will find them?

[3] **A:** Not quite, what that is it's a service [4] used by attorneys when they have a special need.

[5] Your first characterization was [6] incorrect. It is not people who want to be expert [7] witnesses. It is attorneys who contact people [8] with special expertise and discuss their needs [9] with them, and if the individual is able to [10] provide assistance in the particular need the [11] attorney has, then to some degree, they come to an [12] arrangement as to how that service would be [13] provided.

[14] Technical Advisory, TASA, has a list [15] of tens of thousands of specialists in the widest [16] range possible, and they assist attorneys when [17] they have very special unique technical needs that [18] you cannot easily be obtained by asking other [19] attorneys or calling a college or something of [20] that nature, because they draw on experts that are [21] not only in this country but this hemisphere and [22] worldwide because there are so many specialized [23] needs.

[24] **Q:** You list yourself also a potential expert

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[1] on a lot of different subjects with TASA?

[2] **A:** I list myself — I have checked off [3] categories which have to do with the full range of [4] equipment, refining equipment, or compression [5] equipment, machinery equipment, plant safety [6] aspects, reliability aspects, associated with [7] refining plants, chemical plants, production [8] units.

[9] In short, all the areas that I have [10] developed expertise that I described in my [11] credentials when we began this session this [12] morning.

[13] **Q:** And, in fact, that's how the Honeywell [14] lawyers located you in this case is they went to [15] this TASA agency?

[16] **A:** Yes.

[17] **Q:** And there is another agency that you list [18] yourself with as putting yourself in touch with [19] lawyers; is that fair?

[20] **A:** That's correct. Actually, that one is [21] not so much with lawyers, that has to do with [22] insurance companies.

[23] **Q:** So you work for insurance companies [24] through that agency?

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[1] **A:** I don't work for insurance companies. [2] What I have is representative insurance companies [3] when they have special technical claims, they will [4] — they occasionally contact me and ask me to [5] make an evaluation of the — whatever the claim is [6] to determine if the technical basis is valid.

[7] **Q:** And it's fair to say that you've [8] testified as an expert witness about 30 times in [9] your career?

[10] **A:** Excuse me, I have to correct something.

[11] As far as the Hudson International [12] work which you are describing with insurance [13] companies, that's basically an advisory capacity. [14] I provide them with a technical assessment.

[15] **Q:** Leaving that aside and looking at just [16] the times you've actually testified in court or in [17] a deposition as an expert witness for a company, [18] that's happened about 30 times?

[19] **A:** No, I've only testified, I've only [20] testified five or six times. I was trying to [21] remember this morning because I knew you would ask [22] this question. Because you asked it at [23] deposition, so I assume you would ask it again.

[24] I couldn't remember whether it was

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[1] five or six times, offhand.

[2] **Q:** You have been retained as an expert [3] witness in litigation, I believe you said at other [4] depositions about 30 times?

[5] **A:** Yes, about 30 times. But even there — I [6] was thinking about that this morning and I [7] realized when I even referred to that, often they [8] were technical advisory where it was basically no [9] resolution that I was involved in. I was advising [10] — that is there was no deposition, there was no [11] trial, it basically was providing a technical [12] resource in a particular issue that was involved [13] among various companies and they wanted to have an [14] independent evaluation of what the circumstances [15] were.

[16] Some of these were arbitration [17] of arrangements. And so that's difficulty in [18] answering the question of how many of these I was [19] involved in because they don't fall into a very [20] tight category.

[21] The only things I can speak [22] specifically of are the times I've been deposed [23] and the times I've actually testified as an expert [24] in Court.

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[1] **MR. HERRINGTON:** Thank you, [2] Mr. Muller.

[3] **THE COURT:** Mr. Putnam, redirect?

[4] **MR. PUTNAM:** No redirect of this [5] witness, Your Honor.

[6] **THE COURT:** You may step down.

[7] **THE WITNESS:** Thank you very much.

[8] **THE COURT:** Your next witness.

[9] **MR. KRUPKA:** Your Honor, the next [10] witness is going to be William VanSanten by video [11] deposition.

[12] It's my understanding Mr. Ziegler [13] wanted to consult with the Court before we do the [14] transition statement.

[15] (Beginning of side-bar.)

[16] **MR. ZIEGLER:** Your Honor, this is [17] just a question of trying to gauge the Court's [18] philosophy on the purpose of transition [19] statements. If the parties are prepared to act in [20] the same way, the proposed transition statement to [21] me means like a belief as opposed to an [22] explanation. This is this witness offering [23] testimony on a given subject or, this way [24] describes and summarizes what he says in

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[1] considerable length and reads like a brief or a [2] summation.

[3] **THE COURT:** What is the subject of [4] Mr. VanSanten's testimony?

[5] **MR. KRUPKA:** He's testifying, Your [6] Honor, with respect to the knowledge that he on [7] behalf of Sundstrand and other people at [8] Sundstrand had of the two patents at issue during [9] the course of their operation.

[10] **THE COURT:** This goes to [11] willfulness?

[12] **MR. KRUPKA:** It goes to willfulness.

[13] **THE COURT:** Do you want to explain [14] to the jury that this witness will assess them in [15] the determination of will infringement?

[16] **MR. KRUPKA:** Yes, Your Honor.

[17] **THE COURT:** Rather than going in a [18] proffer.

[19] MR. KRUPKA: Well, I'm happy to be [20] guided by Your Honor.

[21] THE COURT: Well, I think if we have a problem, apparently we do.

[22] MR. KRUPKA: My understanding what [24] Mr. Ziegler was saying, we have a problem, my

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[1] offer is I'm happy to.

[2] MR. ZIEGLER: Transition statements [3] are not a brief. I'm new to transition —

[4] THE COURT: I would suggest you [5] avoid brief-like transition statements. Let's try [6] to educate the jury on the various phases of the [7] trial that we're moving into with. The witness' [8] testimony will speak for itself.

[9] MR. KRUPKA: That's fine, Your [10] Honor.

[11] MR. ZIEGLER: Thank you, Your Honor.

[12] (End of side-bar.)

[13] MR. KRUPKA: Your Honor, these [14] formal looking documents are the actual [15] transcripts of the depositions. I have one for [16] the Court and one for the clerk in the event that [17] you want to follow along.

[18] May I make the transition statement, [19] Your Honor?

[20] THE COURT: Yes.

[21] MR. KRUPKA: Ladies and gentlemen of [22] jury, the next witness is William VanSanten. He's [23] an attorney. He's one of the private attorneys [24] that I mentioned in the opening who did work for

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[1] Sundstrand and we are now entering a [2] phase of the [2] case that deals with the [3] subject of willful [3] infringement and the [4] knowledge that the attorneys [4] for Hamilton Sundstrand, both the outside [5] attorneys and the in-house attorneys [6] and people at [6] Hamilton Sundstrand had of the existence and the [7] substance of the '194 and the '893 patents [8] dating back as far as 1986.

[9] (Videotape).

[10] Q: State your full name for the record, [11] please?

[12] A: William Albert VanSanten, Jr.

[13] Q: Who are you employed or associated with?

[14] A: I am a partner in the law firm of Wood, [15] Phillips, VanSanten, Clark & Mortimer in Chicago, [16] Illinois.

[17] Q: Am I correct that the Wood, Phillips [18] represents Sundstrand?

[19] A: We have for a number of years, [20] yes.

[21] Q: Am I correct that Wood, Phillips [22] continues to today, through today, to actively [22] represent Sundstrand?

[23] MR. HERRINGTON: Object to the [24] form.

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[1] A: That is correct.

[2] Q: But I take it you've have either been [3] employed by —

[4] (Stop videotape)

[5] MR. ZIEGLER: Your Honor, I [6] apologize for the interruption. Can we approach [7] side-bar?

[8] (Side-bar conference.)

[9] MR. ZIEGLER: My clear [10] understanding, and I believe there was a letter [11] proposing this to me from Mr. Putnam, was that all [12] designations would exclude colloquy by counsel of [13] objections, and the very first segment there is [14] portion of this where frankly there is one [15] direction not the answer because it's privileged, [16] there is repeated questions, I frankly just [17] assumed based on the way it's normally done and I [18] believe the letter that Mr. Putnam, the way they [19] proposed to do it that all colloquy would be [20] excluded.

[21] MR. KRUPKA: Actually, Your Honor, [22] there is two things going on here. First of all [23] as that last example is a good example, there is [24] an overlap between the objection and the answer,

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[1] and it's technically impossible to completely [2] separate it.

[3] The other is, Your Honor, there was [4] a letter that was sent last night and I think [5] previously that indicated because they hadn't [6] agreed with us that we were leaving things in [7] because they had objected to things and these were [8] substantial or the subject of their objections.

[9] And I wanted — for example, last [10] night I wrote a letter and said we were planning [11] on leaving it in at their request unless they got [12] in touch with us and told us to leave it out. It [13] doesn't relate to this particular one. With [14] respect to these, Your Honor, we can't physically [15] separate the two because of the overlay.

[16] THE COURT: Let's separate out the [17] overlap issue because that's technological problem [18] that we'll just have to live with.

[19] MR. ZIEGLER: The price of video.

[20] MR. KRUPKA: The other instance, [21] Your Honor, if that's what they want us to do, [22] we'll be happy to do it.

[23] THE COURT: Are you able to do it [24] now or do you want to do it overnight?

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[1] MR. KRUPKA: With respect to this [2] one, Your Honor, I did talk with Mr. Schulman. He [3] said with respect to this one you can't do it [4] because of overlap because of the way it was [5] done. Any other ones we do we'll immediately [6] eliminate those things.

[7] MR. ZIEGLER: Your Honor, this is [8] the one that I believe, in fact, maybe has a [9] paragraph on the transcript of repeated objection, [10] and repeat question and objection, and ultimately [11] no answer.

[12] MR. HERRINGTON: Instruction not to [13] answer.

[14] THE COURT: Can we get the [15] transcript?

[16] MR. KRUPKA: Mr. Schulman, they're [17] raising a concern with respect to apparently there [18] is a section of this where there was an [19] instruction not to answer and then some colloquy [20] and then ultimately an answer. Is that included [21] in the video or is that taken out.

[22] MR. SCHULMAN: My belief is that the [23] instructions not to answer are included in the [24] video. And I don't think there ever was an answer

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[1] to the question, so I think the video leaves it [2] with an instruction not to answer.

[3] MR. ZIEGLER: I just assumed it had [4] been taken out. It's page 323 of the transcript [5] starting at line 10 and it keeps going through 325 [6] line 14.

[7] THE COURT: Is it possible to edit [8] that?

[9] MR. KRUPKA: I'll see right now, [10] Your Honor.

[11] MR. KIRK: We can just turn the [12] volume down.

[13] THE COURT: That's one solution.

[14] MR. HERRINGTON: There is another [15] tape you can play if it takes a while to fix this, [16] there is the Crowe tape.

[17] MR. SCHULMAN: Sure.

[18] THE COURT: I'll be right back. [19] I'll just wait. Just wait. I hate to have the [20] jury sitting over there.

[21] MR. KRUPKA: Your Honor, that [22] apparently is the very end of the video, so we can [23] just stop it.

[24] THE COURT: Agreed, Mr. Ziegler.

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[1] They said it's at the very end of the video. [2] We'll stop it.

[3] MR. ZIEGLER: As long as they stop [4] it, that's fine.

[5] THE COURT: All right.

[6] (Side-bar ended.)

In The Matter Of:

Honeywell International Inc., et al. v.
Hamilton Sundstrand

Trial Volume Number 5
February 9, 2001

Hawkins Reporting Service
715 N. King Street
Wilmington, DE 19801
(302) 658-6697 FAX: (302) 658-8418

Original File 020901FC.V1, 287 Pages
Min-U-Script® File ID: 2719580293

Word Index included with this Min-U-Script®

[6] **Q:** So Hamilton Sundstrand Corporation is [7] part of United Technologies Corporation?

[8] **A:** That's correct.

[9] **Q:** Can you tell the jury what the other [10] major parts of United Technologies?

[11] **A:** Well, within United Technologies, [12] Hamilton Standard is part of Flight Systems that's [13] Sicorski.

[14] **Q:** What is Sicorski?

[15] **A:** Sicorski is one of the world's largest [16] manufacturers of helicopters for commercial and [17] military applications.

[18] **Q:** What are the other part of United [19] Technologies?

[20] **A:** Otis Elevators. I noted the elevators in [21] this building are Otis elevators.

[22] **Q:** I don't think that's something they want [23] to brag about.

[24] **A:** We also have Carrier Air Conditioning.

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[1] And of course our biggest division is Pratt & [2] Whitney, which manufacture many of the very large [3] gas turbine engines that power commercial and [4] military aircraft.

[5] **Q:** Let's focus on the Hamilton Sundstrand [6] Corporation today, Mr. Johanson. Can you tell the [7] jury its principal products that it makes?

[8] **A:** We're a very diversified company. We [9] have one of our larger divisions is the Electric [10] Power Group and they produce the electric power [11] generation equipment virtually every aircraft made [12] in the free world and many, many military [13] applications as well.

[14] In our division of course we [15] produced APUs as you've heard plenty of today. We [16] also produce in our division, cooling fans, oxygen [17] generating systems and within the mechanical [18] division we produce a number of things like gear [19] boxes, main engine starters, actuation devices [20] that actually move the control surfaces on the [21] aircraft and many of the equipment that hang on [22] the outside of an engine both APUs and main [23] engines.

[24] We're also, we have an air — or

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[1] space and undersea division which produces for [2] underwater torpedo engines. And for in space, we [3] produce space suits. The astronauts that are out [4] in space today have Hamilton Sundstrand space [5] suits, so as they're doing their spacewalks.

[6] **Q:** How about the Space Shuttle Atlantis, [7] that got them to space today, is there any [8] Hamilton Sundstrand product used on the Space [9] Shuttle?

[10] **A:** Yes, we do. In addition to space suits, [11] we have also the emergency power units that are on [12] board the Space Shuttle in case they have a power [13] loss.

[14] We have some, I think, three or four [15] of those units on board the Space Shuttle.

[16] **Q:** Approximately how many employees does [17] Hamilton Sundstrand have today, Mr. Johanson?

[18] **A:** We're about 17,000 worldwide.

[19] **Q:** Where are the principal locations where [20] those people work for Hamilton Sundstrand in the [21] United States?

[22] **A:** For myself, San Diego. We have [23] manufacturing facilities in Windsor Locks is where [24] we're actually headquartered, Windsor Locks,

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[1] Connecticut. We have manufacturing facilities in [2] Puerto Rico, Nebraska, Illinois, Colorado. I'm [3] sure there are others, they just don't occur to [4] me.

[5] **Q:** In addition to facilities in the United [6] States, does Hamilton Sundstrand also have [7] facilities outside the US?

[8] **A:** Yes, as I mentioned, we're a worldwide [9] corporation. We have facilities in Italy, we have [10] facilities in China, France, United Kingdom, [11] Singapore, I believe in Japan as well.

[12] **Q:** Has Hamilton Sundstrand received any [13] awards for its work on airplane equipment?

[14] **A:** In what aspect?

[15] **Q:** Anything from Boeing?

[16] **A:** Yes. I'm sorry. We have from time to [17] time some of our original equipment manufacturers [18] such as Airbus or Boeing. They do honor their [19] suppliers, or airlines suppliers for the support [20] they've provided in either supporting the product [21] or the quality of the product that they deliver, [22] or the timeliness of their correspondence and [23] Sundstrand has received awards from Boeing.

[24] And I believe also from American

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[1] Airlines and Delta Airlines within the last 12 to [2] 24 months.

[3] **Q:** What award did it get from Boeing in the [4] year 2000?

[5] **MR. KRUPKA:** Your Honor. [6] Objection. I don't have — I object to background [7] about if we get into specifics, I object.

[8] **THE COURT:** Do you want to [9] rephrase?

[10] **BY MR. ZIEGLER:**

[11] **Q:** Are you aware of an award that Hamilton [12] Sundstrand received in the year 2000 from Boeing?

[13] **A:** Yes. We received a Supplier of the Year [14] Award.

[15] **Q:** Now, Mr. Johanson, could you describe for [16] the jury — withdrawn. You've described a number [17] of different products that Hamilton Sundstrand [18] manufactures. Let's now focus on auxiliary power [19] units.

[20] Does Hamilton Sundstrand manufacture [21] auxiliary power units for aircraft.

[22] **A:** Yes, we have. We have been in the gas [23] turbine engine for 24 years.

[24] **Q:** Focusing on the current day, what are the

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[1] different airplanes for which Hamilton Sundstrand [2] manufacturers auxiliary power units, putting [3] military ones aside for the moment?

[4] **MR. KRUPKA:** Objection, Your Honor.

[5] **THE COURT:** See counsel at [6] sidebar.

[7] (Side-bar conference.)

[8] **THE COURT:** What's the basis of the [9] objection, Mr. Krupka?

[10] **MR. KRUPKA:** The objection is that [11] during the course of discovery they took the [12] position that no APU other the APS 3200 accused [13] product had any relevance to any issue in this [14] lawsuit.

[15] As Your Honor will recall, there was [16] a narrow accepting that Your Honor agreed to, [17] actually the parties agreed to in the presence of [18] Your Honor with respect to a single unit at the [19] pretrial conference.

[20] Having taken the position that all [21] other APUs are irrelevant, we object on relevancy [22] and prejudice grounds that since we have had no [23] opportunity to take any discovery or receive any [24] discovery on any APUs other than the APS 3200, I

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[1] object to having this witness testify about any [2] APU other than the APS 3200.

[3] I didn't mind the general background [4] that described the business, but as soon as we got [5] into specific models, I feel I'm prejudiced [6] because I have no discovery on it and they took [7] the position it was irrelevant.

[8] **THE COURT:** Mr. Ziegler.

[9] **MR. ZIEGLER:** Your Honor, this is [10] background information. I'm not going to be [11] eliciting anything about the technical features of [12] any —

involved in negotiating these deals and we don't get into any of the conclusions or opinions

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or experience he has with respect to any particular APU or any particular sole source contract, and we don't get into any of the discussions about when we are negotiating a sole source deal, this is what I do, this is what happens and that this is what our experience has been, which I'm precluded from cross-examining.

I have no problem, Your Honor, as long as you're talking about well, I'm involved in negotiations and some of them are in dual source situations against Honeywell and some of them are in sole source situations, as long as it doesn't go into any of the details or description of what happens in these other deals that we've been precluded from get any discovery on because they took the position they were irrelevant, I don't have a problem.

But as soon as we get into well, what's your experience been on the basis of these other deals or a comparison of his other deals to the APS 3200, then I have a prejudice because I'm not able to cross-examine him with respect to those other experiences because they took the position those documents were irrelevant.

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THE COURT: To that extent, I'm going to sustain the objection. Okay.

And give you lead to try to accomplish your task without resorting to that level of detail. Okay?

MR. ZIEGLER: Thank you.

MR. KRUPKA: Thank you, Your Honor.

(End of side-bar conference.)

THE COURT: You may continue, Mr. Ziegler.

MR. ZIEGLER: Thank you, Your Honor.

BY MR. ZIEGLER:

Q: Mr. Johanson, could you describe to the jury briefly the history of Sundstrand's entry into the APU markets?

A: The original APU or small gas turbine engine was designed by a company that Sundstrand actually later acquired called Turbomeca, back before that the parent company was solar turbines.

They built their first small turbine engine in 1957. It actually powered a US Navy gyrocopter.

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Subsequent to that they started in the business with APUs that were put on military helicopters and generator sets, just about every US military helicopter in the '60s and 70's had a solar Turbomeca APU in the back and we provided those APUs to start the main engines and provide power in the aircraft.

Later on in the 70's, we got on board the F 16 program and provided to, actually to Sundstrand at that time, the jet fuel starter so that the F 16 has a way to start the main engine.

It's the only source of starting power for that main engine. And I think we've delivered well in excess of 3,000 of those units.

Around 1985, we were acquired by Sundstrand and merged into the Sundstrand Aerospace division. And we continued to develop military and commercial APUs.

About 1987, we got into the larger commercial engines, we were moving into regional transport aircraft and then subsequently we were looking at the larger aircraft to broaden our commercial business, which started off with a 737

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and that was the APS 2000 APU. Subsequently, the APS 3200 and a number of other military APUs as well.

Q: Can you explain to the jury what led Sundstrand to decide to develop the APS 3200 for use on the Airbus A320 airplane?

A: Well, if we back up just a little bit, we had been looking at the APS 2000 as a commercial APU, and the opportunity came that there was a problem with the incumbent supplier on that aircraft to the extent that a major European carrier came to us and asked us if we would develop an APU and put it on Boeing 737, that airline was Lufthansa.

And we came to an agreement with Boeing and eventually became a second source on that airplane with our APS 2000.

During that period the Airbus A320 had also entered commercial service, I think that was around 1988. And again, there were problems and a great deal of customer dissatisfaction, and we saw an opportunity there to create a new and better product and we did that.

Q: When you say there were problems and a

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great deal of customer dissatisfaction,

Mr. Johanson, what were you referring to?

A: The unreliability of the APU, the incumbent was the 36-300. And I thi we saw excerpts from Aviation Wee articles that evidenced the fact that the airlines that were operating it were unhappy with its performance.

Q: Just for clarity, who was manufacturing the 36-300 APU that you've just been describing?

A: Currently the name of the company is Honeywell.

Q: And when was it that customer dissatisfaction with Honeywell's 36-300 came to Sundstrand's attention?

A: Early 1989.

Q: And what did Sundstrand determine to do?

A: What we did is we examined the possibility of developing an APU of that size, and we decided it was quite an expensive project so we went and searched for a partner.

Q: And what was the reason for attempting to find a partner to develop the APS 3200?

A: The cost of developing one of these units is very, very high. We felt that we needed to,

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number one, have someone who would share the cost of that development, and number two, it was a European designed aircraft, manufactured in Toulouse, France by a consortium of European countries.

So European content was a very important factor in being able to compete for that airplane.

Q: What was the company that Sundstrand decided to team up with to make the 3200?

A: It was Turbomeca, that's a division of Labinal.

Q: Is that a French company?

A: Yes, it is.

Q: What was your position — well, withdrawn.

What was the name of the joint venture that Turbomeca and Sundstrand created?

A: Auxiliary Power International Corporation, which everyone commonly calls APIC.

Q: Did you have a position with APIC, Mr. Johanson?

A: Yes, I was marketing manager.

Q: When did you become marketing manager for

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APIC?

need them?

THE COURT: Yes, we do.

R. HERRINGTON: Great.

DIRECT EXAMINATION

BY MR. HERRINGTON:

Q: Mr. Shinskey, would you please introduce yourself to the jury?

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A: Yes. I'm Francis Gregway Shinskey. I am a process control consulting engineer. I am a self-employed engineer operating out of my home in New Hampshire.

I have many years of experience in industry, chemical industry, and instrumentation industry, and have spent since approximately 1957 working in process control exclusively of industrial plants and facilities.

Q: Mr. Shinskey, if you could explain, what is "process control"?

A: Process control involves controlling variables in plants and in machinery so that the plant or the machine operates safely, profitability, meets production objectives.

Q: And does that field include surge control?

A: That field includes surge control,

Q: Surge control of compressors?

A: Of compressors, yes, yes, sir.

Q: And have you, yourself, designed surge control systems?

A: I have.

Q: On approximately how many projects?

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A: Oh, perhaps 20 projects.

Q: Let's go back and review your education.

When did you graduate from college?

A: I graduated from college in 1952 with a degree, bachelors of science and chemical engineering.

Q: Where did you go to school?

A: The University of Notre Dame.

Q: And after receiving your diploma, what did you do?

A: After receiving my diploma, I was commissioned as a naval officer having participate in the ROTC program at the university. And I immediately went to active military duty Korean War on a destroyer.

For how long were you in Korea?

A: I was there for two years.

Q: And what did you do when you finished your tour of duty?

A: When I finished my tour of duty, I joined the DuPont Company in the Savannah River, an atomic energy plant in Georgia.

Q: When did you first begin to work in the field of controls?

Page 1323

A: From DuPont, I went to work for Olan Chemical in 1955. And after two years working for Olan chemical, and gaining some experience working with controls, repairing them, in fact, I was appointed the instrument engineer for the group of pilot plants which were manufacturing high energy fuels at the Olan facility in Niagara Falls.

Q: For how long did you work at Olan?

A: I work at Olan from 1955 until 1960.

Q: Where did you go after that?

A: When I left Olan in 1960, I began work for the Foxboro Company in Foxboro, Massachusetts. The Foxboro Company is an old line instruments and control systems manufacturing company.

Q: And are you still working in the field today?

A: I still am working in the field today. I retired from the Foxboro Company in 1993, and after retiring, I continued to be actively working in the field of process control. I have very many clients who use my services to help them control their plants.

Q: At some point, Mr. Shinskey, did you

Page 1324

begin writing about controls?

A: Yes, I did. I found that my education in process control that I was able to obtain did not, while it was interesting to learn the theory of how process controllers behave, I found that the information available from academic sources was not adequate to help me in a plant situation, so I developed my own method for analyzing process control loops and improving the performance of control in plants situations.

So at that point I began instructing the engineers who I was associated with at Foxboro in my methods of achieving better performing control systems.

Q: And when did you first write a book on controls?

A: I was teaching Foxboro engineers in my methods when the — the head of the research department asked me if I would write a book on the subject, which I did, and which my first book was published in 1967. It is not in its fourth edition.

MR. HERRINGTON: Your Honor, if I may, may I ask Mr. Shinskey to identify his first

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book that he just referred to and we also have the second edition?

THE COURT: You may.

BY MR. HERRINGTON:

Q: I've handed you what we've marked as Defendant's Exhibit 1196 A and B. If you could please, just identify those?

A: Yes, 1196 A is the first edition of process control systems published in 1967. And Exhibit 1196 B is a second edition which was published in 1979.

Q: And what is the general subject of those books?

A: They go through the theory of process control, how controllers function. And how to achieve the best performance out of control loops. They describe controllers of various kinds and then they concentrate specifically on controlling different types of processes, pumps, compressors, heat exchangers, boilers, distillation columns, all the variety of processes that you would find in a more than processing plant.

Q: Do they contain some discussion of surge

Page 1326

control of compressors?

A: Yes, they do contain a discussion of surge control.

Q: Now, in addition to your books, is it fair to say you've also written articles over your career?

A: I have written, as was mentioned, more than 100 articles on process control, yes.

Q: I don't want to embarrass you, but you've received awards throughout your career from the Instrument Society of America, the American Institute of Chemical Engineers, the Institute of Measurement and Control of the United Kingdom, the Nordic Process Control Group and the American Automatic Control Council?

A: That's correct.

Q: And I understand that this spring you're to be inducted into the Control Hall of Fame?

A: That's correct.

Q: Mr. Shinskey, you've also had occasion to teach controls to other engineers?

A: Yes, I have participated. I have given many, many seminars over the

years since my — I [24] began writing, I also began giving seminars and I

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[1] have given, on the average, of five to six [2] seminars a year, perhaps more than that in some [3] years, since about the last 30 or 35 years.

[4] **Q:** Now, one of the issues in this case is [5] what a person of ordinary skill in the art to [6] which the Honeywell patents apply would understand [7] and be able to do.

[8] And, I believe you have an [9] understanding of what you think a person of [10] ordinary skill in the field would be?

[11] **A:** Yes. A person of ordinary skill in the [12] art in this field would be someone with a degree [13] in engineering, would have perhaps five or more [14] years experience in applying control systems to [15] industrial plants and facilities. And some of [16] those control systems would be associated with [17] controlling compressors.

[18] **Q:** Now, based on your own experience as of [19] the time period of February 1980 and the late [20] 1970's, would you have an understanding of what [21] would be known and understood by a person of [22] ordinary skill in this field?

[23] **A:** Yes. Back at that period of time I would [24] have been that person of ordinary skill and my

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[1] colleagues at Foxboro Company, my colleagues in [2] industry with whom I worked, and also the students [3] that came to me for training in advanced control [4] systems would have been representative of persons [5] of ordinary skill in the art.

[6] **Q:** Mr. Shinskey, I want to discuss the [7] patents and the APS 3200, but before we do that, I [8] would like to give you an opportunity to give the [9] jury a brief tour, if they like, of the APS 3200.

[10] **MR. HERRINGTON:** Your Honor, may I [11] ask the jury would step down? We have it over [12] here.

[13] **THE COURT:** Chance to stretch your [14] legs, ladies and gentlemen.

[15] **BY MR. HERRINGTON:**

[16] **Q:** Please.

[17] **A:** Now, as the previous witness had [18] mentioned this is not an operating APU, but it is [19] a mock up, but it is of the same size, weight, and [20] so forth. It's made of the same parts that would [21] be an operating APU.

[22] We have at the far end is the [23] engine, the external engine which spins the [24] turbine blades and so forth, and the parts powered

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[1] to the shaft, T shaft turns both the power [2] compressor which is on this side and the load [3] compressor which is on this side.

[4] Air for this machine is drawn up [5] from underneath, there is a large opening, the air [6] comes vertically upward from openings underneath [7] and spins around in the load compressor and is [8] discharged right at this point.

[9] Now, at this point, the air can go [10] in two different directions. The compressed air [11] enters the bleed control valve at this point and [12] the bleed control valve can either send air to the [13] aircraft or to the exhaust.

[14] And it has a what we call a [15] butterfly valve, which can swing from left to [16] right and close off either one port or partially [17] close off the other port.

[18] The valve is operated by an electric [19] hydraulic actuator right here which receives a [20] signal from the surge control system in order to [21] adjust its position in one direction or the other.

[22] The guide vane operator is this [23] motor right here. And as the guide vane operator [24] is — receives a signal, it moves its shaft in and

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[1] out which opens or closes the louvers, the guide [2] vanes that you have seen in the other compressor.

[3] The additional features, there is [4] the generator at this end, and of course the [5] exhaust is over here, and whatever air is not [6] delivered to the aircraft goes here because the [7] aircraft demand might be less than the surge limit [8] for the compressor, whatever additional air beyond [9] what is required by the aircraft, then is bled to [10] the exhaust through the bleed surge control.

[11] **Q:** Thank you.

[12] **MR. HERRINGTON:** Your Honor, [13] Mr. Shinskey has prepared a set of digital aids [14] that I would like to show him and then present to [15] the jury if I may.

[16] **THE COURT:** You may.

[17] **MR. HERRINGTON:** Would you like [18] copies for the Court?

[19] **THE COURT:** Yes.

[20] **MR. HERRINGTON:** Three?

[21] **THE COURT:** Two.

[22] **MR. KRUPKA:** Your Honor, may we have [23] a side-bar.

[24] **THE COURT:** Yes, I'll join counsel

Page 1331

[1] at side-bar.

[2] (Side-bar conference.)

[3] **MR. KRUPKA:** I'll let Mr. Putnam do [4] it.

[5] **MR. PUTNAM:** Your Honor, I gather [6] Mr. Herrington's intent is to give these demonstratives to the jury, which I would object [8] to assuming that they have all been disclosed [9] before and we need to look through — I don't have [10] any objection him showing them to the jury, but I [11] think having the jury have them in their [12] possession, even if it's just during the course of [13] Mr. Shinskey's testimony would be prejudicial. [14] They are not evidence, they can illustrate his [15] testimony. I don't think it's appropriate that [16] copies be given to the jury.

[17] **MR. ZIEGLER:** Your Honor, it's just [18] at way of letting them follow along. It's a small [19] version.

[20] **THE COURT:** Are these going to be [21] displayed?

[22] **MR. HERRINGTON:** Yes, in addition to [23] being displayed.

[24] **THE COURT:** Just display them, to

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[1] avoid any further dispute.

[2] **MR. HERRINGTON:** Okay.

[3] (End of side-bar conference.)

[4] **THE COURT:** Members of the jury, [5] we'll just have them displayed for your benefit on [6] the screen as we did before

[7] **BY MR. HERRINGTON:**

[8] **Q:** Mr. Shinskey, I want to turn now to the [9] question of whether the APS 3200 infringes the two [10] patents at issue in this case, the '893 and '194 [11] patent.

[12] Did you conduct an evaluation of [13] that issue?

[14] **A:** I did.

[15] **Q:** And did you reach a conclusion?

[16] **A:** I definitely reached a conclusion, yes.

[17] **Q:** What was your conclusion?

[18] **A:** My conclusion is that the APS 3200 surge [19] control system does not infringe either the '893 [20] or the '194 patents.

[21] **Q:** If you could, please explain, just [22] briefly, what the basis for your opinion is?

[23] **A:** If we look closely at all of the claims [24] of the two patents, we find that in every claim is

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[1] the feature of adjusting the set point of the [2] surge controller as a function of inlet guide vane [3] position, or of changing the proportional integral [4] output signals are the source of the controller [5] signal as a function of inlet guide vane position.

[6] In the APS 300, the guide vane [7]

position is neither used to set the set point of the surge controller nor does affect the proportional and integral parts of the surge controller in any

Q: Mr. Shinskey, I would like to give you copies of the patents?

MR. HERRINGTON: Your Honor, if I may?

THE COURT: Yes.

Q: What we call the '893 patent is Defendant's Exhibit 2, and the '194 patent is Defendant's Exhibit 3.

Mr. Shinskey what did you do to familiarize yourself with these patents and the claims at issue?

A: Well, I read the patents and their claims in close detail. And in light of my experience in controlling surge in various compressors over the

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years, and also in light of what was considered to be the state-of-the-art at the time prior to the filing of these patents.

And I was surprised to find out that the elements of the claims upon which the patents depend were commonly practiced, not only singly, but also in combination, in combinations similar to combinations which appear in the patents at that time.

For example, the flow related parameter is a very common flow related parameter, which was used to measure the flows of compressed air and gas in many, many applications, not only surge control back at this period of time.

And so I was somewhat surprised that these patents were even granted.

Then after having familiarized myself with all of the characteristics of the control systems as described in the patents, then I investigated the way surge control was provided in the APS 3200.

And I found some, again, very unusual differences. For example, I discovered that the inlet guide vane position in the 3200

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does not set the set point of the surge controller as it does in the patents.

I also discovered that the variable used by the surge controller in the APS 3200 is not the same variable as the flow related parameter in the patents, it's quite different.

In fact, the surge variable, the variable which is used to control surge in the APS 3200, I discovered that I had never seen that used to control surge before in any work that I had ever done or in any publications that I have ever read.

That is the use of the pressure rise across the diffuser as an indication of the approach to surge in a compressor.

Q: Mr. Shinskey, what did you look at to become familiar with the operation of the APS 3200?

A: I looked very thoroughly through the specification. What we have talked about earlier is the ECB or Electronics Control Box requirement specification for the APS 3200, which describes the — in block diagram form and also in text how the control system for the APS 3200 functions

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MR. HERRINGTON: Your Honor, if I may show Mr. Shinskey what's been marked as Defendant's Exhibit 26?

THE COURT: You may.

BY MR. HERRINGTON:

Q: Mr. Shinskey, if you could, please, identify what we have marked here as Defendant's Exhibit 26?

A: Yes, this is the APS 3200 ECB requirements specification, revision N. This is the same document I was using.

Q: Before we talk about what the patents claim and what the APS 3200 does, could you give a brief summary of how a surge control system works?

A: I believe I can.

A surge control system in order to prevent surge from developing in a compressor, the surge control system has to maintain at least a certain minimum flow through the machine.

And the difficulty that we have in controlling a surge in a compressor is that the particular value of minimum flow which will be safe as far as surge goes is not a constant. It varies with many different things. It varies with

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the compression ratio of the compressor. It varies with the speed of the compressor. With the opening of guide vanes. It varies with the composition of gas which is being compressed, and also with the temperature of the gas being compressed.

And so it's a fairly complicated science to be able to arrive at an effective surge control system for a compressor. And the control system which is best for a given compressor may not be best for another because compressors vary based on again whether we have a constant speed, variable speed, inlet guide vanes or not, whether the system pressure is constant temperature, gas composition and so forth.

Q: Is a surge control system an example of a closed loop system?

A: A surge control system is a closed loop system, yes.

Q: We have a figure from your 1967 book. And if we can project it on the screen and have you explain the basis of a closed loop controller.

MR. HERRINGTON: Your Honor, may the

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witness approach the board here?

THE COURT: Yes.

A: This is the simplest example of a closed loop. And I would like to identify the inputs and outputs to the controller.

We have an input entering from the right, which is identified as the set point. And as we have defined the set point in the last few days, it is the desired value of the variable which we wish to control.

And if we would like the temperature in our home to be 68 degrees, we would set the set point of the thermostat at 68 degrees.

On the other side of this circle entering from the top, we have what we would call the controlled variable. And for the thermostat in our house that would be the temperature of the room would be the controlled variable which we would wish to be maintained at set point.

In the case of a surge control system, the set point is whatever value of the controlled variable, be it flow or whatever we're using as a controlled variable. That would represent a safe condition and still an economic

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condition. A safe condition means we're not going to go into surge. We are protected from surge by maintaining that value, an economic condition means that we would not waste compressed air unnecessarily by operating far away from surge.

Then the comparison between the controlled variable and the set point is developed here in this circle then is what we might call a comparator.

The difference between the controlled variable and the set point is the error signal. And it has been called the error signal and it appears that way in other documents which we have looked at this week.

The controller acts in such a way as to try to maintain the error as close to zero as possible. So the controller is where the proportional and integral actions will take place.

The output of the controller will

then move some variable such as the fuel flow to [21] an engine, if we wish to control the speed of an [22] engine. The fuel flow to a heater, if we wish to [23] control the temperature of the heater and so [24] forth.

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[1] And so the controller almost always [2] manipulates some type of flow by moving a valve.

[3] And so how here we would have some [4] type of a valve actuator, and let me just put a [5] general term in here. An actuator, a signal going [6] to an actuator which would move it and cause a [7] change in the controlled variable, whether the [8] controlled variable is flow or temperature.

[9] Finally, when we make this [10] adjustment by means of the actuator to the [11] process, the result of that is that the controlled [12] variable is affected, and if the controller is [13] controlling properly, the controlled variable will [14] be returned to set point and maintained there.

[15] **Q:** One of the common examples of a closed [16] loop control we talked about is cruise control on [17] a car?

[18] **A:** Yes, we did talk about cruise control on [19] a car. In that case our controlled variable would [20] be the speed of the car as sensed by the [21] speedometer. Our set point we set by hand when we [22] push the little button on the end of the cruise [23] control handle, and about when we push the button [24] at a particular speed, then that places the

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[1] controller on automatic and there's that value of [2] speed as the set point.

[3] Now, this arrangement as shown here [4] applies quite well to cruise control. The [5] controller then moves the throttle in the car and [6] causes an increase or decrease in the speed of the [7] engine. In that case the car would be our [8] process. The controlled variable would be speed. [9] And the actuator would be the throttle on the [10] engine.

[11] Now, there is — cruise control [12] would be a relatively simple thing if there were [13] no disturbances of any kind. But we find out when [14] we're driving a car that if we start going up [15] hill, the hill increases the load on the engine, [16] and so there is another variable here which I will [17] identify as the load variable.

[18] And the load variable is a variable [19] which is quite often not measured, but which [20] causes a disturbance to the controlled variable [21] which requires the controller to readjust its [22] output and the actuator to rebalance the system.

[23] So if we start going up a hill, the [24] load on the engine increases, the speed then

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[1] falls. And falling below set point creates an [2] error signal which causes the controller to move [3] the throttle in a direction that will bring the [4] speed back to set point by matching the load on [5] the engine with increased fuel flow.

[6] **Q:** Now, Mr. Shinskey, looking at the set [7] point, that term, that's the desired value?

[8] **A:** The set point is the desired value. In [9] the cruise control system it is the desired speed [10] at which we wish to operate the vehicle.

[11] **Q:** I want to talk about the patents, and the [12] patents talk about adjusting the set point of a [13] surge control system based upon a position of the [14] inlet guide vanes, is that fair?

[15] **A:** Yes, the patent does talk about that.

[16] **Q:** First of all, I would like to get an idea [17] of what inlet guide vanes are and I think we have [18] an image of some inlet guide vanes.

[19] Mr. Shinskey, if you could explain [20] what we're seeing here?

[21] **A:** The inlet guide vane is a ring of vanes [22] that you can see and the vanes open or close to [23] allow more or less air to in the compressor. And [24] when the guide vanes move, then they change both

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[1] the flow and the compression ratio of the [2] compressor.

[3] If the guide vanes are nearly [4] closed, then the compressor has a low capacity and [5] delivers a low pressure. If we need to increase [6] the capacity of the compressor, we open the guide [7] vanes and that delivers more flow and a higher [8] pressure at the same time.

[9] **Q:** Does the position of inlet guide vanes [10] affect when surge will occur?

[11] **A:** Yes, it does. There is a relationship [12] between the flow, which will be minimum, to [13] prevent surge and the position of the guide vanes.

[14] As the guide vanes are more open, we [15] will require more flow through the compressor to [16] avoid surge than if the guide vanes were nearly [17] closed, for example.

[18] **Q:** I think we have an illustration of that. [19] If, you could, please, explain what we see here in [20] this chart?

[21] **A:** Yes. This is a representation of [22] compression ratio achieved by a given compressor, [23] plotted against the flow delivered by the [24] compressor in volume metric units. By volume

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[1] metric units we would, for exam talk about [2] cubic feet per minute.

[3] And each one of these curves that [4] you see on the screen position of the guide vane. [5] So the curve next to the word "minimum" would [6] represent the minimum opening of the guide vanes [7] and the curve next to maximum would represent the [8] maximum opening of the guide vanes.

[9] Now, the relationship between the [10] flow and the pressure on these curves, you'll [11] notice that it goes through a maximum value. Each [12] one of these curves has a maximum value.

[13] And on the right side of that [14] maximum value we have stable operation of the [15] compressor. It behaves perfectly well. There is [16] no difficulty in controlling the compressor.

[17] However, if we allow the flow to [18] decrease so that we fall onto the left side, that [19] represents an unstable operation of the [20] compressor, and that's what's called surge.

[21] So rather than the flow being [22] maintained at that peak value, it will tend to [23] fall to a zero or even negative value so that it [24] will pulse back into th compressor, that causes

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[1] the pressure to rise again to drive the flow back [2] here and you have pulsations existing.

[3] And the pulsations can be on the [4] order of once per second within the compressor and [5] that's what can do the damage to the internals of [6] the compressor.

[7] Each one of these curves, again each [8] curve represented by a different guide vane [9] position passes through a maximum. And if we [10] connect the maximum values together, then what we [11] have established here is the surge limit.

[12] Everything to the left of this line [13] I have shown by connecting the dots represents a [14] surge condition and everything to the right is [15] stable.

[16] And as you see as we open the guide [17] vanes, the minimum flow to protect the compressor [18] from surge keeps moving towards an increased [19] value.

[20] **Q:** Mr. Shinskey, if you might maybe trace in [21] some of those lines because I don't think they're [22] very visible. And if you could, maybe explain [23] what each line represents as far as how open the guide vanes would be?

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[1] **A:** This entire first line that I have drawn [2] in in black represents the